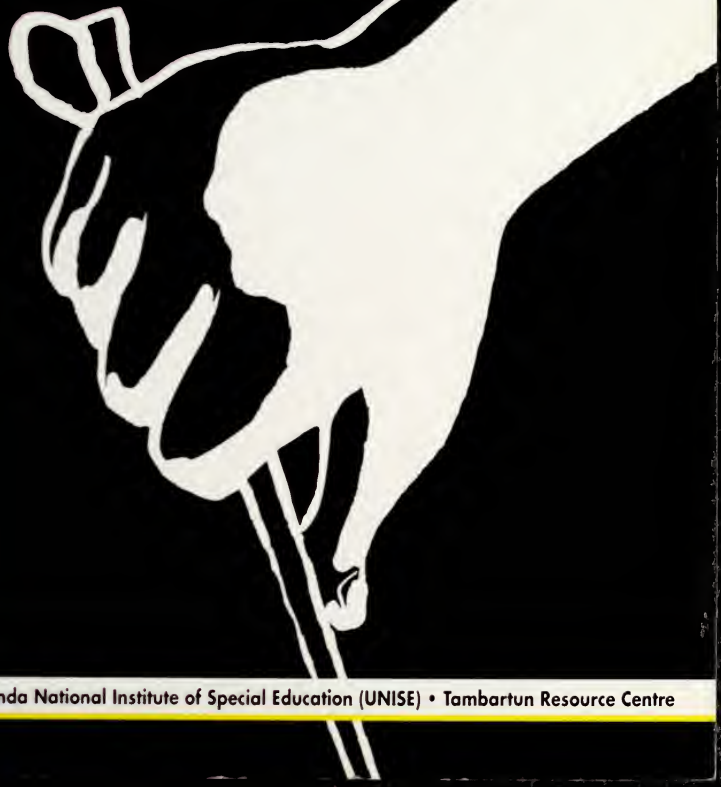
Teacher's Guide

Mobility in a Functional Context



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GOAL-ORIENTED MOBILITY TRAINING IN A FUNCTIONAL CONTEXT

Magnar Storlykken, Harald Martinsen, Jon Morten Landrø, Bengt Elmerskog and Jon Magne Tellevik

Tambartun National Resource Centre for Special Education of the Visually Impaired,N-7084 Melhus, Norway

and University of Oslo.

GOALS IN MOBILITY TRAINING

The term "functional mobility training" comprises two important aspects of functionality. One is the requirement to integrate mobility training in a comprehensive ability and rehabilitation plan. Mobility training should be considered in connection with the contribution it can make to overall measures and also be correlated with other parts of the total training offered to pupils. Particular stress should be placed on correlating mobility training with ADL and language and communication training. Total intervention perspective consequently includes all that is being done to improve the quality of life.

Total intervention perspective is realized in the fixed activities of the subject during a day or a week. As a rule it is the pupil himself and his parents, who together with teaching staff, those responsible for housing, leisure and health, select, plan and adjust these activities. Such total training is always to be based on the main goals for training pupils. These include:

- improved security and overview
- improved communication and language abilities
- improved social integration with others
- improved independence
- improved leisure
- improved well-being

Activities in a total intervention decide how mobile pupils need to be. The place where activities are located is thus the natural point to move to. Therefore the analysis of the mobility that is needed and necessary is decided by the priority activities within the total intervention perspective. The overall need for mobility is decisive for the priorities given to specific goals in such training.

The second aspect of "functional mobility training" is that the pupil himself experiences it as functional. This means that the mobility goals are consistent with the pupil's personal goals. For example, the mobility skills are seen to be necessary to get to places where certain activities are, or to reach something one wants. This means coping with everyday life and participating in social events. If there are no functional goals in mobility training the result may be passivity and dependence on help.

Three pupils with different requirements illustrate how training has to consider mobility both as part of a total training concept and as functional training.

DESCRIPTION OF CASES

Tor: a blind pupil who functions satisfactory

Tor is a blind pupil who functions satisfactory and is able to take the initiative to meet friends, agree on a meeting place and does not need to be accompanied. He has contact with fellow pupils in the schoolyard and does not depend on other pupils taking the initiative. Tor can avail himself of the services provided by society in a normal independent manner. He can make his own way to the library and swimming pool, for example. He can travel by bus and train and pop into a cafe if he wants to. At home and in his leisure time Tor can move independently from place to place at will without mobility being a problem.

Tor's mobility training is part of his total training

Tor's total intervention plan is the result of thoroughly determining the functional and training needs as well as defining the goals for the training itself. Total intervention contains the activities or requirements Tor needs to work towards his main goals.

The activities that are described in the total intervention plan are those he needs to get through the day, from when he wakes up in the morning to when he goes to bed. These are the activities that make the schoolday, the workday, and leisure time as valuable as possible. Tor's normal activities are washing and dressing, having breakfast, brushing his teeth, putting on outdoor clothing and footwear, taking outdoor clothing off at school, lessons at school and breaks, putting on outdoor clothing to return home from school, eating dinner, normal leisure-time activities like going for a visit to friends, the youth club, cinema with friends, rehersals of the brass band or sports training etc., eating supper, getting himself ready for bed and going to bed.

When we started working with Tor a total intervention plan was planned and prepared. This was done in close cooperation with the staff, Tor's parents and Tor himself. As it was necessary to make sure that the mobility training was not uncoordinated with his total intervention plan, everyone had to be well acquainted with the main goals and content of Tor's total intervention plan. Tor now knows all the mobility routes for movement to activities in his total intervention plan. His present mobility goals are concentrated on becoming better at using people who are nearby to help reach the place where he wants to go. This means trying to be independent and move around through making specific use of other people. It was necessary to have a new meeting of the group that was responsible to plan this training. The group comprised Tor, his parents, teachers, representatives of the pedagogical and psychological school advisers, and the headmaster. This is taking care of initial training in Tor's immediate environment. To learn to use public offices by himself this will mean that Tor has to take a bus 12 kilometres from his home to the municipal centre. His greatest wish was nevertheless to get to the nearest city to experience a rock concert, which took a lot of careful planning by Tor

and his teacher. This consisted of ordering tickets, transport to the city and back, booking a hotel, transport to the concert and back, making arrangements with the security guards to find his place and the way out of the concert afterwards. Tor found it particularly useful to learn how to get to this city because it was a normal place to travel to for other youth of his age. If youth from rural districts wanted to go to large concerts, football matches or just to meet others, this is where they went. As it was the regional centre, it could also be relevant for further education.

Tor's functional training

Tor is an active boy who quickly tells his mobility teacher that he is ready to learn new mobility skills. This is because he wants to become increasingly engaged in new activities without being dependent on help from others. Functional mobility training for Tor will comprise being trained in the mobility functions that make it possible to participate in activities with his peers. The process of mobility goal attainment is being driven by his wish to be an independent participant in the youth scene, as far as possible.

There should be ample motivation to learn the way to these places because it is important to reach them. For Tor, the aim of mobility training is to reach the places his peers generally buy their records, have a soft drink or get together. What Tor experiences as being functional, probably is exactly that. The feeling of having mastered a mobility operation does not represent the greatest reward, for Tor it is reaching his goal and being together with his friends. The work with Tor had reasonable conditions for success with the training because it was relatively easy to have a common understanding of the goals. Nevertheless, this can fail. We can easily envisage a situation where the pupil wants to learn his own way to the local cafe to meet friends in the evening. The goal can be described in two ways. One, finding the way there is paramount. The alternative, where meeting friends dominates. These two expressions of goals show different attitudes to the same task. It is not difficult to see how this will influence the way stress is placed. In cases where the mobility itself is the most important it is traditional that the technical execution is given great priority. For Tor this implies that focus would be put on the technical skills he acquires with his white cane.

Even for Tor it is difficult to think of good technical accomplishment at the same time as he learns to orientate himself. This makes the learning task more complex than if he could concentrate on one thing before moving to the next. If technical skills remain important for the specialist teachers, this will force the pupil into simultaneous training. In some cases, the technical training can be incorporated along the route the training has been started. Though there is no difficulty with this approach, the pupil should have asked for such training and the instructor should be certain that the pupil understands the connection between this training and his own goals for the training. The danger with stressing technical training is that there can be a gap in the comprehension of goals between the pupil and the pedagogical specialist. This could detract from making mobility training functional and coincide with the personal goals of the pupil. We have already noted that if there are no functional goals in mobility training the result for the pupil may be passivity and dependence on help.

***Åse:** A pupil with multiple handicaps*

Åse, who is a pupil with multiple handicaps, is able to find her way around in her home. She can go from the lounge to the kitchen to have some coffee, move without help from the bathroom to the WC, and find her cassette player if she wants to play some music.

She gets to school by herself, she knows the schoolyard and classrooms and can find her way to the local shop and buy things. She has a limited vocabulary and knows a few sentences by heart. She also uses mobility as a means of communication. She moves to places where an activity she likes usually takes place, collects things associated with that activity, such as shoes when she wants to go out, and thus attracts people nearby to things she wants to do.

Åse's mobility training as part of her total training

At the start of the mobility training, it was obvious that some of the activities in the total intervention plan did not function for Åse. The staff saw that Åse seemed to be frustrated and dissatisfied with such activities. Sometimes Åse hit her own left ear. The activities later that day were partly disturbed because of this. It seemed that the activities were boring. Following a meeting in the group that was responsible for Åse it was decided to look at her total training once again and compare the activities with the main goals for the training. The group also thought that it had been too long since they had considered the things Åse liked to do. Had there been changes since the last evaluation? and could she have become bored with some of the activities?

It became apparent that most of the activities in Åse's total training had remained unchanged during the last three to four years. Some activities like the most necessary ADL activities had to continue to be in her daily plan. These were activities like getting food and drink, washing and looking after her appearance, dressing and undressing etc. Some of the other activities were changed because it was considered that new activities were more suitable than the main goals in the training plan. These were the activities that Åse liked. The new activities were planned with mobility as an introduction to the activity. Åse's largest problem was finding things that were meaningful during her leisure time. The schoolday was fine. However, the afternoons were long and boring. The solution was that Åse used her leisure time to go shopping, walk to the post office to mail and collect her books in braille and visit the local cafe. These were activities she found pleasant and meaningful. She found the visit to the shop particularly fun because the shop assistants had time to have a chat and were very helpful.

Åse's functional training

Functional mobility for Åse was obviously not training in skills that meant that she could participate in activities she wanted, as was the case with Tor. Before Åse could indicate that she wanted a certain activity by going to a specific place, matters had to be arranged so that activities were firmly associated with those

places. Moving to a specific place thus gave an unambiguous message that a certain activity was sought. This shows how the arrangements made by the teacher were a prerequisite for the pupil being able to express her own needs. A "functional goal" must be to make such arrangements so that they can be used to follow up the pupil's own desires when these cannot be expressed by the pupil.

Another factor was that Åse did not like some activities because she had become fed up with them. In such cases the staff, to a certain extent, had to use trial and error. One way to make things easier was to use the knowledge that her parents and those close to Åse had about her likes and dislikes. It appeared later that Åse was not very motivated to walk around with a white cane. Her parents felt that there was a connection with cane training being a former school subject and when Åse followed a specific mobility route it was done in order to learn to use the white cane correctly. Åse's father could not understand why she had to walk with a cane in these lessons. The route was in surroundings that Åse knew well. Also this route was followed many times each lesson. Furthermore, there was nothing particular to do in connection with the route. Åse's father thought she found it boring, and could not understand why she had to walk around with a cane in surroundings she knew and felt secure.

This turned into an important issue during the evaluation of Åse's training. The staff thought that the training seemed satisfactory to start with because Åse became better with her cane technique. Thus she developed in relation to her training goal. Later there was wide agreement that she had stagnated. They decided to move the cane technique training to the mobility route she had to the shop. This was the activity Åse liked best. To start with stress was placed on getting her to learn the way without help from others. Then this was to be followed by adjusting her cane technique. As Åse wanted to move as independently and effectively as possible to the shop, this became a functional way of learning the cane technique.

Per: A mentally retarded boy of nine

Per is a nine-year old boy who has brain damage and is severely disabled. He can only move his arms and legs slightly and is dependent on a wheelchair. He cannot control the wheelchair himself so others have to push or carry him from place to place. He can use his arms and hands to get things that he is interested in when they are placed on a table in front of him. Per is frequently ill and three problems dominate his daily life. He can chew and swallow but quickly gets out of breath when someone tries to give him food or drink. Per has retarded lung function and to breathe freely he is dependent on regular drainage of his lungs. He has epilepsy and can suffer serious attacks. He can have one to three powerful attacks weekly and in some periods these can be even more frequent. When he is excited, he can easily suffer such attacks.

The personnel say that it is difficult to keep Per awake when he is at school. This is a particular problem on "troublesome" days. During these days Per is only allowed to sleep because the staff find it extremely difficult to do anything when he is in this state. It is best to let him sleep. Per has no vocabulary or signs and the personnel who are close

to him are uncertain what he comprehends and understands.

Per's mobility training as part of his total training

Because of his health problems no fixed routines have been established on schooldays. Activities are restricted to when Per is awake and seems to be content. These variations in his condition do not make it possible to formulate clear goals for the training. Most of the time when Per is awake is spent nursing and caring for him. Following a thorough evaluation of Per's functioning new training goals were defined and his daily activities were based on these. Efforts were made to find activities that Per liked. This was done by registering Per's signals in different situations. His mother was able to show us how Per behaved when he said that he enjoyed himself.

We tried to discover this "expression" in various activities. Per liked to rock to and fro when he sat close to and in front of an adult. Also he clearly liked to lie on a trampoline when an adult kneeled over him and made the trampoline move. He also liked people to sing to him and play classical music on the stereo in the classroom. In addition to being good activities for Per, the first two were basic motoric activities that increased Per's arousal. In order to make Per more awake it was also decided to establish a structure where activities were repeated in a specific order each day. This was intended to increase Per's ability to be more alert by giving him a clear overview of what was going to happen during the day. When activities were put in a structured training plan the need for a route became clear. The most enjoyable activities, jumping, rocking and playing music were planned in stations or as parts of a main activity. These were located in a triangle with about three metres between each station. The mobility goal was to roll to activity number one, then to number two and finally to the third activity.

Per's functional training

Per does not have any communication skills that make it possible for him to convey his needs in an unambiguous manner to others. Functional mobility training for him will be based on his teacher's analysis of his total development needs. With pupils that cannot communicate, the objective is to arrange matters so that the pupil's behaviour can be interpreted as communication.

The mobility routes became part of the structure where it was possible to see different reactions from the pupil because he has an overview and expectations about the next activity. Examples are when a pupil starts to dribble when he reaches the last marker in his mobility route before coming to the kitchen where he is going to eat, or when a pupil starts to kick on his route to the trampoline. The characteristics on the route became markers for the activities he is on the way to. The structure in the mobility route thus made it easier for the teacher to react consistently to the signals from the pupil as this route structure maximized the teacher's attention to the pupil at the markers. After a short period of training in this structure Per showed many "signs of pleasure". These signals were interpreted by the teacher to mean that more of the acti-

vity was wanted which led to a situation where Per got control over his surroundings through being able to ask for more of an activity. After a time, Per also rolled himself towards activities when he was removed from his wheelchair. He showed clear signs of pleasure when he reached the trampoline.

Functional mobility from the point of view of the teacher is mobility training that helps to promote basic development goals such as the ability to express a need and thus develop activities involving the pupil. Functional mobility from the point of view of the pupil is realized when the mobility goals coincide with the pupil's own personal goals. As far as Per is concerned, we assume that in a way he had reached his own personal goals when he showed "signs of pleasure". These clear signs of pleasure and the general increase in activity by Per are interpreted as expressions of Per experiencing communication.

All together, these three pupils illustrate that the goals for functional mobility training should be to enhance the pupil's social function, activity, initiative and independence for all blind and weak-sighted pupils, irrespective of the functional level and additional handicap. At the same time, for children and adults with multiple handicaps and problems in communicating with others, mobility training can be a framework that contains efficient language and communication training. When the focus is placed on functional activity, mobility training is tailored to the needs of the individual and becomes an integrated part of the pupil's total training. Functional mobility is to be adjusted so that the mobility goals coincide with the pupil's personal goals as far as possible.

MOBILITY IN CONNECTION WITH ADL

ADL activities are unavoidable in everyday life. These daily tasks such as going to the toilet, getting dressed and eating breakfast mean that the person has to move. The places where such ADL activities are located are thus natural orientation goals. When mobility to activities always proceeds in the same manner, and the person is given a chance to recognize that he is on the way to the goal, the mobility will be associated with the activities. The mobility itself thus acts as a signal or marker for the activities. The association between certain mobility routes and specific ADL activities generates motivation to carry out the mobility when the pupil receives a reward for his mastery of the activities. Some of the activities involve rewards because they satisfy primary needs such as food and drink, others have a reward that comes from being able to carry them out. Some activities are more interesting to go to than others because they involve a pleasurable social situation. These are the breakfast table, coffee table, a youth club visit etc. This means that it does not necessarily have to be the goal for mobility that is interesting, rather the activity that takes place when one arrives.

MOBILITY IN CONNECTION WITH COMMUNICATION

The coordination of mobility training with other types of training has a particularly favourable effect on pupils that require extensive language and communication training. Mobility route training is a systematic, structured type of training that can be employed consciously in user training and training in the comprehensi-

on of language and communication. The structure of mobility route training, characterized by markers and fixed instructions, is equivalent to the traditional pedagogy employed with the deaf-blind and meets the assumptions of "structured total communication" and "marker-controlled framework structuring".

The most important element in mobility training as an element in language and communication training is the use of routes and characteristics on the routes as markers – signals – of the activities the mobility is heading towards. The structure makes the comprehension of words and signs easier because associations with activities, the objects that are used in activities and the use of the objects are more obvious for the pupils. The immediate connection between the characteristics on the route and the start of the activity itself makes it easier for the pupil to know what is being communicated.

LEARNING IN NATURAL SITUATIONS

Coordinating mobility intervention with other training also leads to synergy in the total intervention. In most cases this coordination will be equivalent to learning in natural situations, i.e., learning something in the situation where it is going to be used. This avoids having to transfer learning from an artificial learning situation and gives a greater guarantee that the pupil will obtain practical use of the training. When mobility training is used when the pupil is going to an activity in any case, this saves time compared with having dedicated training in mobility skills. The motivation for learning will also become better because the pupil will understand the purpose of the learning. There is also spontaneity in completing an action and the feeling of having mastered the situation, something that has a positive long-term effect on the tempo of learning.

Natural reinforcement ensures that what has been learned is retained. The reinforcement is found in the situation and will always be there. This type of pay off is only found in the natural learning situations that everyday life is full of. By utilizing these, the staff does not have to use time creating learning conditions that are unconnected to the pupil's daily life. Few pupils understand the point of walking just for the sake of walking. It is consequently difficult to defend making artificial mobility routes – such as in a gymnasium with artificial obstacles – to start training in mobility techniques and other mobility skills. Any extra training should be done when the pupil has understood the use of mastering the mobility skills that the training is given in.

Pupils with extensive and complex difficulties cannot use much time learning things that they will scarcely ever use. For pupils with normal functions the adjustment of mobility training to everyday life will make it easier for them to carry out activities that are enjoyable and useful, such as those that are of practical help in bringing them together with friends and others. Irrespective of the functional level, pointless extra training in mobility skills can in the worst case weaken the general motivation for learning and increase the danger of becoming dependent on help from others.

SUMMARY

One of the objectives of this paper has been to indicate the importance of mobility training for the blind. Our approach is that when such training is placed in a functional perspective and coordinated with other parts of the total intervention, mobility training assumes even greater significance than otherwise for the subjects. Such coordination has the dual function of allowing mobility training to be individually tailored and enabling specific problems for the subjects to be taken into consideration in the planning and carrying out of the training.

This coordination of mobility training with the total intervention places greater demands on the teacher than has previously been the case. In order to realize such coordination of mobility training, it is necessary for the person who is to plan and carry out the training to have a complete overview of the total intervention. This means that the mobility teacher is responsible to present the total intervention concept if it exists, and contribute to the definition of such a comprehensive training offer if this is not already done. Another area of responsibility is defining mobility training as part of the total intervention in a functional manner. This will involve a slight adjustment to traditional teaching tasks since a mobility teacher must be able to evaluate and if necessary create a total intervention concept in order to find sensible training objectives.

Apart from mobility training being planned as part of a training totality, it also has to be directed at goals. The general requirements for satisfactory special education comprise the formulation of training goals, tailoring the physical learning situation and ensuring that the subject who is to be taught is optimally prepared for learning. When the training goals are formulated one has to be reasonably certain that this is based on what the pupil perceives is functional to learn.

It is mandatory in special education that a specific training goal is formulated for all training. The training goal is to be so precisely formulated that the description states what is the correct place, a good method and if applicable, suitable material for the training. Similarly, the formulation of the training goal is to make it clear how the evaluation is to be done.

All special education is to be tailored to the individual assumptions of the pupil and the social environment the pupil is part of. Each single training measure is to be placed in an overall framework that is defined from the needs of the pupil. The overall framework of all such measures that are based on the pupil's needs comprise the total intervention concept.

An important part of the individual tailoring of training is to make systematic allowance for the individual pupil's interests and wishes. The formulated training goals are to be realized so that the pupil is motivated to learn and is aware of what is going on in the training situation. An alert, motivated pupil is the basis for making training effective. The key to an alert, motivated pupil is basing activities on the pupil's interests and wishes. In addition, an objective for the physical tailoring and other ways of structuring the teaching situation is that the pupil pays attention to what is being learned.

FUNCTIONAL MOBILITY TRAINING OF MULTIPLE DISABLED BLIND CHILDREN AND ADULTS

Harald Martinsen, Magnar Storliløkken, Bengt Elmerskog and Jon Magne Tellevik
Tambartun National Resource Centre for Special Education of the Visually Impaired,
N-7087 Gimse, Norway
and University of Oslo.

Introduction

Multiple disabled blind children and adults, who constitute a significant part of the blind population, have traditionally received less mobility training than well-functioning blind persons. This low priority mobility of multiple disabled persons within the mobility field, has both historical and theoretical roots. Historically, adventitious blind adults, mainly war veterans after World War II and the Korean war, were the first to be given systematic mobility training (Harley, Long, Merbler & Wood, 1987). Thus, methods and mobility techniques were desinged with the rehabilitation of well-functioning blind adults in mind.

Theoretically it has been assumed that multiple disabled persons, and also small children, lack learning potential for orientation and independant travel (Miller, 1982; von Schneden & Crecco, 1986). It has, for example, been hypothesized that prerequisites for efficient mibility training include basic motor skills, haptic/tactual exploration skills, ability to localize sounds, and ability to match and recognize objects. For multiple disabled blind persons who lack such skills and abilities, preparatory teaching is often given priority, and training of self-sufficiency in travel is postponed.

For many multiple disabled blind children and adults, passivity and dependence on others, is a severe life problem concatenated with their physical handicaps. Lack of functional mobility skills, adds to such a pattern of passivity and dependency. Thus, it is of major significance for the welfare of the group, to show that they can obtain selfsufficiency in travel through mobility training. There is, however, a dearth of relevant studies. Among the exceptions is a study by Uslan (1979), which demonstrated that mentally retarded blind persons were able to use the white cane for indepentent travel. Functional use of the white cane has also been demonstrated for children between two and three years of age (Pogrund & Rosen, 1989).

The present report describes mobility route learning among multiple disabled and well-functioning blind children and adults. The groups were deffined according to langusge ability and presence of additional handicaps as mental retardation, autism, and motor problems. The effectiveness of the mobility route training for the multiple disabled children and adults, is dis-

cussed in relation to the progress shown by well-functioning participants in the study.

Method

The study is a part of the 1989-91 Tambartun Project. Systematic mobility route training was given in the home environment, supervised by the Tambartun Mobility Group. A project material, including a training method manual and data recording forms, was especially designed for the project. The local teachers of the participants were trained in the use of the project material by the Tambartun Mobility Group.

Fourteen visually impaired children and adults, assigned to two functional groups, participated in the study. Group I, the multiple disabled group, included eight persons. Six of them had a language problem. Two of them used no words or signs, two used only a few words or signs, and two had a relatively large vocabulary, but no, or only a few, phrase-like sentences. Of these six language-

Table 1. Help levels

19. Full guiding.
The helper guides all the way through the stage of the route by leading, pushing etc.

18. Partial guiding at the leading point.
The helper guides part of the way through the stage of the route with tactual contact at the leading point.

17. Partial guiding with distance from the leading point.
The helper guides part of the way through the stage of the route with tactual contact some distance from the leading point.

16. Partial guiding with shadowing.
The helper follows closely, «shadows», the pupil through the stage of the route, and sometimes touches him to make him go on.

15. Visual, auditive help.
The helper stands at the next landmark making sounds. The pupil can see the helper.

14. Auditive help.
The helper stands at the next landmark making sounds. The pupil can not see the helper.

13. Visual help.
The helper stands at the next landmark without making any sounds. The pupil can see the helper.

12. Verbal help.
The helper directs the pupil while he is navigating a stage in the route, by use of speech or signs; telling him to go straight forward, turn to the left, etc. The helper walks behind the pupil.

11. Verbal instruction.
The helper stands at a landmark and tells the pupil to go to the next landmark; naming the landmark.

10. Self-sufficiency.
The pupil navigates independently from the starting point to the goul of the route.

Independent travel.
Mean level of help equal to, or lower than 12, is operationally defined as «independent travel».

impaired participants, three were diagnosed as mentally retarded, two had motor problems, and one was a deaf-blind, socially deprived woman. The last two participants in Group I spoke well, but were diagnosed as mentally retarded and autistic, respectively. Group II included six visually impaired children or adults, who all had normal language skills.

For each of the pupils, the kind of help given to them by the tachers, was recorded for each of the stages in the route; i.e. the distances from the starting point to the first landmark, between the successive landmarks in the route, and from the last landmark to the goal. Ten operationally defined levels of help, coded 10 – 19, were arranged in a rank order from «full guiding» (level 19 – the helper guides all the way through the stage of the route by leading, pushing, etc.) to «self-sufficiency» (level 10 – navigates independently from the starting point to the goal)(Table 1).

For any change in the help level at any stage in a route, cumulated number of training sessions, trials, in the route, was recorded. For various numbers of trials, mean level of halp was computed for each participant. Mean level of help is operationally defined as the sum of the help levels across stages in the routes, divided on the number of routes.

Results

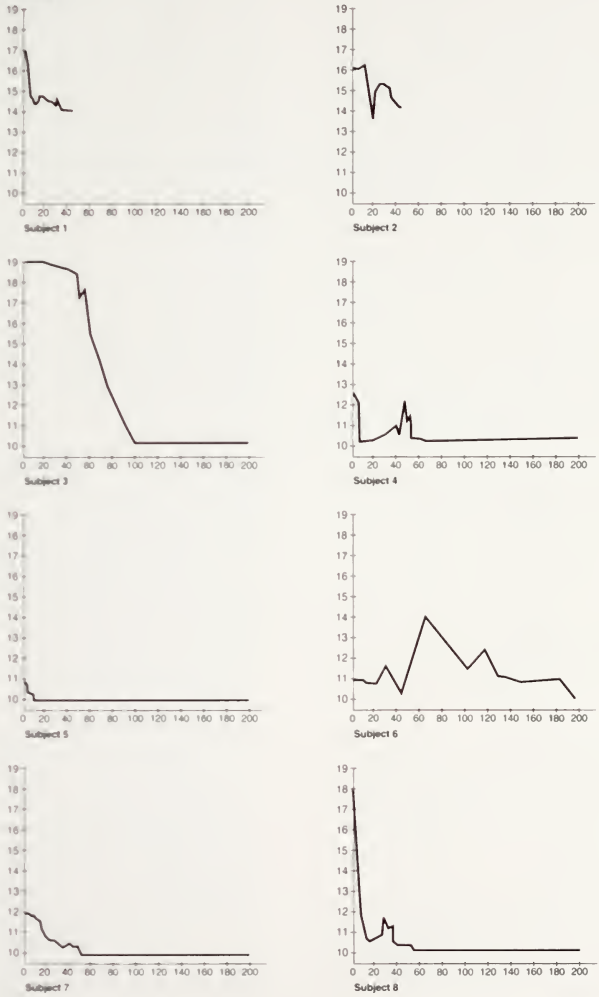
Each of the eight multiple disabled pupils showed progress during the project period, but the degree and rate of learning varied highly. Five of the pupils developed «self-sufficiency» (level 10) in at least one route; the number of trials varying from 11 to 52.

After achieving «self-sufficiency», one of the pupils above suffered a set-back. His increased need of help, was caused by snow fall and ice on the roads, which changed environmental cues and made it more difficult to navigate through the route. He subsequently ended up, after more than 200 trials, at only a slightly lower help level than he showed at the start of the training period.

Two of the three remaining pupils in the group I had less than 50 trials, and performed at a mean help level of 14 («auditive help»), when the project ended. They were able to travel through several stages only with «verbal instruction», while they needed partial guiding (level 18 – 19) in other parts of the route. One of these pupils had a set-back after about 17 trials, when training in a new route started. An analysis of the recordings, suggests that the teachers were overy encouraged by the progress in the first route, and that lack of help made the pupil anxious. The thirs pupil had 78 trials at the end of the project periood. He showed little progress during the first 55 trials, and his mean help level fell to 12 - 13 («verbal help» – «auduitve cues») towards the end of the project period. All these three pupiols continued to progress after the end of the project period.

With regard to initial help level, two of the eight pupils in group I needed «full guiding» (level 19) through the whole route on the first trials. Two others needed full or partial guiding (levels 19 - 17) at several stages in the routes. Two pupils were given only «verbal instruction» (level 11) through most of the routes, while they at other stages

Figure 1


Subject 1
Subject 2
Subject 3
Subject 4
Subject 5
Subject 6
Subject 7
Subject 8

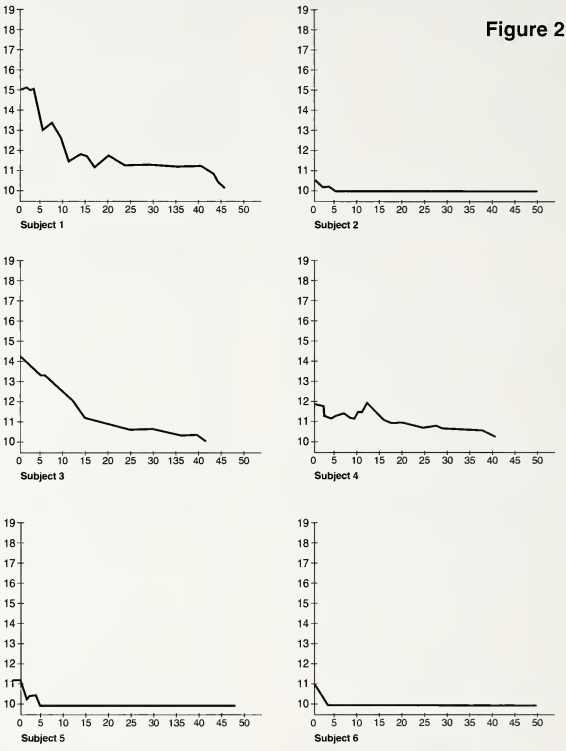


Figure 2

needed «visual» or «auditive cues» (level 13). The last two pupils showed «self-sufficiency» at several stages in the route, and needed only «verbal instruction» (level 11) at most of the other stages.

Three of the six pupils in group II needed only «verbal instruction» when the training started, and acheived «self-sufficiency» in less than five trial. The hree other pupils needed visual, auditive or verbal help at the start of the training period. One of these pupils acheived «self-sufficiency» after 41 trials. The other two still needed «verbal instruction» at most stages of the project period; after about 45 trials. The last two pupils were the youngest of the participants. One of them was five, and the other eight years of age when the project started.

Figures 1 and 2 show the learning

progress in groups 1 and 2, respectively. Mean level of help is shown on the Y-axis. The X-axis shows numbers of trials since the training started.

The difference detween the multiple disabled and the well-functioning blind, is shown both with regard to initial level of help and learning progression. The group difference in initial help level, is statistically significant (Mann-Whitney U, two-tailed, p< 01). There were, however, large individual differences within both groups, and the groups overlapped with regard to initial help level and number of trials before independent travel was acheived. The overlap between the groups and the within-group differences, show that initial help level and learning progression can not be attributed to differences in language skills or mental ability alone.

DISCUSSION

The findings emphasize the importance of offering mobility training to all blind and visually impaired persons, mental, motor or other additional handicaps notwithstanding. It was demonstrated that multiple disabled blind persons can be taught independent travel by means of mobility route training. It seems possible to teach all visually disabled children and adults independence in travel, as long as they are not hindered by debiliating motor handicaps, progressive loss of functions, or other medical conditions.

Some multiple disabled persons may, however, need a long training period before acheiveing independent travel, and setbacks should be expected during the training period. The most severly disabled, will presumably always be in need of a compaion in their daily travels.

The fact that even multiple disabled blind persons were able to acheive independent travel by mobility route training, have important pedagogocal and theoretical implications. It shows that preparatory training is not required even for the most disabled of the blind population. The theoretical bias against teaching mobility to multiple disabled persons who do not master certain skills and concepts, seems to be unfounded. Preparatory training may restrict multiple disabled persons from learning self-sufficiency, prolong their dependency on others, and impose upon them an unneccessary degree of passivity.

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IMPORTANCE OF FUNCTIONALITY AND GOAL-ORIENTATED ACTIVITY IN MOBILITY TRAINING

Jon Magne Tellevik, Magnar Storliløkken, Bengt Elmerskog, and Harald Martinsen.

Tambartun National Resource Centre for Special Education of the Visually Impaired,
N-7084 MELHUS, Norway.
and University of Oslo.

TWO ASPECTS OF FUNCTIONALITY

Human spatial movement usually takes place for some particular purpose, is deliberate, and is often associated with solving a problem. Mobility and orientation skills is in this respect functional for reaching desired goals.

The term 'functionality' incorporates two important aspects. The most important one is that mobility training should give an understanding of why mobility skills are necessary for reaching a desired goal. For the individual, this enhances motivation and affects plans for daily life challenges. Functionality in this sense implies activity related to functional goals, which is intrinsically motivating for performance.

The second aspect signalled by the term 'functionality' is the demand for integration of mobility training in a total plan for habilitation or rehabilitation. This requires an analysis of the individual needs within a larger perspective. By integrating mobility in a total plan, mobility training becomes more significant for the educational goals for each individual, and may frequently function as a frame for development of daily living skills, language and communication. In the present paper we argue that these two aspects of functionality can be met in a method based on mobility route training.

INDIVIDUAL PLANS AND GOAL-DIRECTED ACTIVITY

Goal-directed activity, plans and motivation.

To perform competently in the environment, the individual must choose an organizing goal or perspective, — a plan (Holyoak & Nisbett, 1988). In spatial problem-solving a plan, or goal, crucially affects behaviour in a way that one particular aspect rarely does. A plan specifies necessary prerequisites for the activity, as well as situational uncertainties as to how it should be carried out. It introduces a new type of relationship between the individual and the environment; specifying a set of operators, or actions, within a relevant problem space.

Plans are guided by our expectancies or cognitive structures available and motivate performance. It is learning to achieve functional mobility goals which makes training of skills to reach a goal meaningful and satisfactory. To be competent in mobility implies

choosing a plan which makes it possible to move from a starting point to a goal. In functional mobility training the consequence of this is analyses of individual needs and defining goals related to authentic, ecological valid, problems, i.e. challenges met in everyday activity. The emphasis on ecological validity, inherently links motivation to the execution of individual plans.

When understanding why an activity should be performed, an individual effectively learns relevant skills which are defined with reference to individual needs. Hence, the goal-object is essential for establishment of some features of cognitive structure, how to represent the mobility problem. That includes knowledge of what steps or moves are possible for reaching a goal. Functional goals thus both motivate a search for a path, and representation of the problem. Consequently, ecological validity, or authenticity, is an inherent aspect of the reasoning process.

The role of mobility route training within a total plan for habilitation and rehabilitation.

Mobility route training has for some time been integrated within individual plans for habilitation or rehabilitation at Tambartun, The National Resource Centre for Special Education of the Visually Handicapped in Norway. Generally, acquisition of mobility skills positively influence the individuals level of activity and sense of well being. Furthermore, mobility route training seems more significant for intellectual and social development, as well as language and communication, than traditionally assumed.

Generally, the problems encountered by blind people require training in order to develop several skills and abilities. Teaching functional skills must be coordinated within a larger perspective. To train skills independent of each other requires considerable use of time. In addition, there is often a problem of generalization to new settings. To decide which skills shall have priority is often difficult, especially when dealing with multiple disabled individuals. Developing basic skills out-of-context is time consuming and less effective than training related to authentic problems. Mobility training, when integrated within a total plan for habilitation and rehabilitation, is effective for coping with daily life. When the development of necessary abilities and skills are related to authentic problems, training becomes ecological valid and meaningful for the individual.

Language and communication abilities are inherently associated with mobility training. When such abilities are poorly developed, they restrict the possibility to ask necessary questions to solve the task, and it is difficult to instruct the individual to perform adequately. Communication difficulties make the training situation rather uncomfortable, and is often associated with lack of motivation. Low motivation is inappropriate for learning, and often leads to passivity. Successful attempts to reach a goal positively affect motivation, language, and communication, and creates a feeling of well-being. When dealing with a choice of perspective, or a plan, which we feel responsible for, we get emotionally involved in the result of our choice(Dreyfus & Dreyfus, 1986). A successful result is of course deeply satisfying, and leaves a vivid memory of the situation encountered as seen from the perspective of the goal chosen. An unsuccessful result is, on the other hand, not easily forgotten. These memories are not only related to salient

cues in a route, but also to senses of opportunity, risk, expectations, threats, etc. Such gripping memories induce joy and excitement, and an urge to communicate about them in travelling the route.

A route may thus be regarded as a whole situation, which differ in one important respect from particular aspects, or cues, as such. A whole situation, since it is a result of a plan or perspective, has a 'three-dimensional' quality, which is often lacking when considering particular aspects. Certain elements stand out as more or less important with respect to the plan, while other elements are not paid attention to, or forgotten(Tellevik, 1992; Tellevik & Martinsen, 1991; Thorndyke & Hayes-Roth, 1982). This is consistent with the fact that systematic search patterns are generally more motivating and effective for learning than less systematic activity (Fletcher, 1982).

THE EFFECTIVENESS OF MOBILITY ROUTE TRAINING

A consistent pattern of development is found in mobility route training. In learning to travel a route independently, several qualitative shifts are observed. These shifts are related to attention, communication, and use of environmental cues.

Firstly, attention typically appears as anticipations to landmarks. Anticipations, or preview, may take many forms. Most frequently, the individual slows down, speeds up, or stops while travelling in a route. Anticipations also appear as changes in directions and usage of the cane, and in protective actions as lifting, or lowering the arms. Frequently, subjects talk about the landmarks, or show joy and excitement immediately before reaching them. Such anticipations indicate discovery of new relations or qualities, associated with the landmarks.

Secondly, anticipations is often followed by communication related to the landmarks, even for individuals with relatively poor ability to communicate. Success in mobility routes triggers communication about actions and experiences in searching for a goal. Thus, mobility routes frequently function as a frame for the development of language and communication. A feeling of success does not only motivate mobility and orientation. It also positive affects the development of other, important, daily life skills.

Thirdly, when the individuals become more proficient in travelling the route, attempts to modify skills, techniques, and use of landmarks, may be observed. They become more attentive towards appropriate cues, include additional ones, and exclude others through taking short cuts in the route. This kind of reorganization of the travel plan, suggests a spatial understanding, which is not restricted to recognition of landmarks and turns in the route. Competence in using and adjusting a plan, requires understanding of the spatial layout, and implies spatial knowledge relevant for orientation. Spatial understanding and orientation skills, may appear as the ability to communicate about objects, events and places in a space, pay attention to landmarks, and to modify the search plan.

MOBILITY ROUTE TRAINING IN A FUNCTIONAL PERSPECTIVE

Plans and the acquisition of procedural and declarative knowledge.

The goal-object, by its presence or absence, verifies or refutes hypotheses regarding its location. Traversing between origins and destinations, imply identification of environmental cues, landmarks. In doing so, we must identify salient landmarks and change directions, in order to successfully reach a destination. Spatial movement is the process of changing location over time, commonly referred to as route or procedural knowledge utilization. Procedural knowledge, embodies knowledge of specific paths through an environment. It includes ability to preview and anticipate information, in order to develop and organize a travel plan, and heuristics, or strategies, which translate plans into spatial activity (Gäthing, Böök & Lindberg, 1985; Moa & Rosleton, 1982).

Attention to salient information for reaching a goal, is paramount for subjects who are concerned with searching for a path to a goal. Thus, procedural knowledge is the kind of knowledge that is most important, in order to learn to travel through a mobility route. A learning of such procedures implies selective attention to some aspects of the layout, which leads to differential learning effects. Initially, mobility route learning implies attention to landmarks that constitute the route, which is a significant indication of procedural knowledge utilization.

Successful performance in a route eventually induce the ability to estimate the nature and severity of barriers occurring along the route. This implies an ability to modify a travel plan to circumvent such barriers, even when unknown segments of a space are traversed. The ability to modify a travel plan also makes it possible to take short-cuts that are convenient to reach a destination. In a cognitive perspective, such actions require knowledge of environmental features, declarative knowledge. Declarative knowledge consists of knowledge of objects, persons, events, things, and places. It includes knowledge of the existence of objects or places, and recognition of them within a sensory field. Eventually an ability to communicate with others about cue properties and relations between objects, becomes part of declarative knowledge. Establishing procedural knowledge through learning to navigate along a route, thus implies acquisition of declarative knowledge, which in turn associates with orientation skills.

Mobility route training and coping with daily life.

In mobility and orientation, it is mandatory to prepare for functional route training in relation to both aspects incorporated in the term 'functionality'. Referring to the first aspect, the individual must understand why mobility skills are necessary to reach desired goals. If he/she does so, training of mobility skills become functional to goals relevant for coping with daily life. In practice, this often implies that the mobility teacher initially must focus on mobility routes that is motivating for the individual to reach a desired goal. The mobility route must represent the solution of a real, or authentic, problem for the individual, in order to be meaningful and satisfactory.

Referring to the other aspect, a demand for authentic goals requires an analysis of the individual needs in a larger educatio-

nal perspective, which is significant for habilitation and rehabilitation. Functional mobility route training not only affects development of mobility and orientation skills, but may also function as a frame for developing language, communication, and understanding of social relations.

Mobility route training frequently affects initiatives to take part in other activities. The experience of success may thus be regarded as an effect of experiences associated to coping with daily life challenges. The feeling of success in travel creates a feedback chain, which triggers other activities and goal-directed movements. Using procedural knowledge to reach goals, implicates learning how-to-do-it to make other desired goals available. Procedural knowledge utilization leads to goal-directed activity, which implies acquisition of declarative knowledge, and eventually associates with orientation skills.

IMPLICATIONS

In our opinion, mobility training must have a more central and comprehensive role in relation to habilitation and rehabilitation. When mobility training is integrated in a total educational plan, and adjusted to functional goals for the individual, it becomes effective as a means for coping with the problems of the blind population. In this perspective, learning of mobility skills frequently triggers initiative in other activities, language and communication, and a feeling of being comfortable in daily life. In a wider perspective, mobility route training counteracts passivity, which is a major problem for many blind people.

The experiences with a functional use of mobility route training, described in the present paper, contradict the common assumption that it is necessary to establish declarative knowledge through preparatory training of basic mobility techniques and orientation skills. Successful performance in mobility and orientation does not depend on spatial knowledge and mobility skills learned out of a functional context. Many blind people often perform successfully on such out-of-context tasks, but still remain passive. They have learned about objects, events, and places out of functional contexts, but not learned how to use such knowledge to obtain desirable goals. Many blind people do, however, show ability to obtain desired goals through mobility route training, albeit they have poorly developed spatial understanding and orientation skills.

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GENERALIZED EFFECTS OF MOBILITY ROUTE TRAINING

Harald Martinsen, Bengt Elmerskog, Jon Morten Landrø, Magnar Storliløkken and Jon Magne Tellevik

Tambartun National Resource Centre for Special Education of the Visually Impaired, N-7084 Melhus, Norway
and University of Oslo.

INTRODUCTION

Mobility is involved in mostly all daily-life activities, and the lack of functional mobility skills intertwined with passivity and dependence on others, which are common problems among visually impaired persons (Blakeslee, 1980). Functional mobility skills are closely associated with the ability to travel independently, and with goal-directed activities, which are intrinsically meaningful for the individual. The ability to move independently between different places and activities, is an important aspect of self-sufficiency. It reduces the need for support from other people, enhances activity and personal initiative, and creates opportunities for experience and learning. In an important sense, acquisition of functional mobility skills makes it possible for the visually impaired person to cope better with the challenges of daily life, feel competent, and gain self-respect. Thus, successful mobility training may have wide-ranging consequences for the life quality of the visually impaired population.

In the present paper, the effectiveness of mobility route training is discussed with regard to independent travel, orientation, communication, activity level, mood, and sense of well-being. It is argued that such training may influence the development of spatial understanding, communication, and emotion in a more comprehensive manner than usually acknowledged. It is further argued that functionality in the above sense is a main prerequisite for the occurrence of positive generalized effect.

METHOD

Subjects and procedure

The study is a part of the 1989-91 Tambartun Project (Storliløkken, Martinsen & Landrø, 1991). Seventeen visually impaired children and adults from the northern and western parts of Norway were given systematical mobility route training, within a methodological frame coined 'functional'.

The mobility training was given in the participants' own home environment, supervised by the Tambartun Mobility Group. A project material, including a method manual and data recording forms, was especially designed for the project. The local teachers of the participants were trained in the use of the project material by the Tambartun Mobility Group. Age, sex, visual impairment, and additional handicaps of the participants, are shown in Table 1.

Table 1.
Age, sex and disability of subjects

AGE	SEX	VISUAL IMPAIRMENT	ADDITIONAL HANDICAPS
05	HE	TOTAL BLIND	NONE
10	HE	TOTAL BLIND	NONE
08	SHE	SOCIAL BLIND	PHYSICALLY DISABLED
19	SHE	SOCIAL BLIND	MENTALLY RETARDED
11	HE	TOTAL BLIND	PHYSICALLY DISABLED
04	HE	TOTAL BLIND	PHYSICALLY DISABLED
44	SHE	TOTAL BLIND	DEAF
36	HE	SOCIAL BLIND	MENTALLY RETARDED
34	HE	TOTAL BLIND	MENTALLY RETARDED
14	HE	TOTAL BLIND	NONE
12	HE	TOTAL BLIND	AUTISME
08	HE	TOTAL BLIND	MENTALLY RETARDED
16	HE	TOTAL BLIND	NONE
29	SHE	TOTAL BLIND	MENTALLY RETARDED
11	SHE	TOTAL BLIND	NONE
42	HE	TOTAL BLIND	MENTALLY RETARDED

Routes

Training and mobility performance was recorded in a total number of 247 out-of-door routes. Each of the pupils were observed in at least two routes, the number of routes observed varying from 2-9. The number of landmarks in the routes, varied from 4 to 26, and the length of the routes from approximately 3 to 1400 meters. The physical conditions for navigation of the routes, varied according to seasonal changes in the weather.

Measures

Events recorded as measures of qualitative shifts in behavior.

Positive and negative changes and shifts in behavior which occurred during the project period with regard to:level of help, anticipations of landmarks in the routes, short-cuts in the routes, communication, mobility techniques, activity/initiatives, and mood, were recorded.

For shifts which took place during the navigation of the routes, the following kinds of information were recorded: description of the event, event class or domain, the number of the route in which the change occurred, number of days since the training started, cumulated number of trials in the route, and concurrent significant events (e.g. snow falling, the pupil met a friend on his way to school).

For shifts which took place outside the mobility route training sessions, the following kinds of information were recorded, description of the event, event class or domain, description of the situation in which the change occurred, number of days since the training started, and concurrent significant events.

Shifts which occurred, were also described by help of a questionnaire given to the local teachers at the end of the project period. The teachers assessed the effectiveness of the mobility route training, and were asked to describe positive or negative changes shown by the pupils with regard to the above-mentioned classes or domains of events.

Level of help.

Decrease or increase in the amount of help given to the pupils while the routes were traversed, were recorded. For each of the pupils, the help given by the teachers during navigation of the routes, was registered for each of the stages in the route; i.e. the distances from the starting point to the first landmark, between the successive landmarks in the route, and from the last landmark to the goal. Ten levels of help, coded 10-19, were specified and arranged in a rank order. The definitions of the levels are:

19. Full guiding. The helper guides all the way through the stage of the route by leading, pushing, etc.
18. Partial guiding at the leading point. The helper guides part of the way through the stage of the route with tactual contact at the leading point.
17. Partial guiding with distance from the leading point. The helper guides part of the way through the stage of the route with tactual contact some distance from the leading point.
16. Partial guiding with shadowing. The helper follows closely, shadows", the pupil through the stage of the route, and sometimes touches him to make him go on.
15. Visual, auditive help. The helper stands at the next landmark making sounds. The pupil can see the helper.
14. Auditive help. The helper stands at the next landmark making sounds. The pupil can not see the helper.
13. Visual help. The helper stands at the next landmark without making any sounds. The pupil can see the helper.
12. Verbal help. The helper directs the pupil while he is navigating a stage in the route, by use of speech or signs; telling him to go straight forward, turn to the left, etc. The helper walks behind the pupil.
11. Verbal instruction. The helper stands at a landmark and tells the pupil to go to the next landmark; naming the landmark.
10. Self-sufficiency. The pupil navigates independently from the starting point to the goal of the route.

Independent travel. Mean level of help equal to, or lower than 12, is operationally defined as 'independent travel'.

When the help level at any stage in route changed from the previous time the route was trained, the number of times the pupil had navigated through the route (number of trials), was recorded. Number of trials were counted from the initial time the pupils were presented with the routes.

Mean level of help is computed as the sum of the help levels for all the

stages in all routes at a given number of trials. Mean level of help indicates the kind of help given to the pupil. Since the help levels are described as an ordinal scale, the measure must not be interpreted in an interval manner.

Anticipation

The category was scored when the pupil anticipated a landmark in the route, - showed preview. The most commonly observed behaviors were

- Decrease or increase in speed immediately before reaching the landmark.
- Stop before reaching the landmark, searching for the landmark with the cane, hands, or feet.
- Excitement or joy immediately before reaching the landmark.
- Change of mobility technique immediately before reaching the landmark; e.g. shifting the way the cane is held, using a protection technique, etc.
- Listening behavior immediately before reaching an auditory landmark.
- Goal-directed changes in movements or posture immediately before reaching the landmark.
- Mention of the landmark before the landmark is reached.

Short-cut

The pupil changes direction and walks towards a landmark which is placed in a later stage of the route, excluding the preceding landmark(s).

Mobility techniques

Scores in this category were recorded whenever the pupil used a mobility technique not employed earlier; including techniques for keeping track of an auditory or tactile/haptic guiding line, protection, crossing of streets or open spaces, localization of objects, etc.

Communication

Scores in this category were recorded when the pupil started to communicate in a new, and more competent manner; includes the use of words, signs, and non-verbal communication; i.e. starts to talk about the landmarks in a route, repeats the instructions given, more often talks/communicates non-verbally during navigation of the routes, initiates more often communication with other persons.

Activity/initiative

Scores in this category were recorded when shifts in activity within or outside the training sessions were observed. Shifts in activity included using trained routes for new purposes, acquisition of ADL skills, increased social activity, exploration, becoming more awake, attentive, or vigilant, etc.

Mood

Scores in this category were recorded when the family or the teachers reported that the mood of the pupil changed; includes being more often happy, 'looking proud', less angry, ceased to seem listless, etc.

Mean serial rank order of qualitative shifts

For each of the participants, the changes observed was assigned a rank from 1-7, according to the order in which they occurred during the project period.

The changes which did not occur, were assigned a tied rank. Mean rank order across participants, was computed for all the qualitative changes. The differences in mean rank order reflect how relatively early the changes averagely occurred in the project period.

RESULTS

Occurrence of qualitative shifts

Positive shifts in behavior or mood, were recorded for all of the participants. For seven of them, questionnaire information showed positive shifts with regard to all domains in question. Negative shifts were recorded for only two of the pupils; a boy with Spielmeyer-Vogt Syndrome, and a clinically depressed woman with acquired blindness.

Anticipation of a landmark in a route, which is an early manifestation of layout knowledge, was shown by 14 of the 16 participants. A total of 122 anticipations were recorded. To stop walking immediately before reaching the landmark, was the most frequent form of anticipation; shown by 13 pupils. Eight pupils changed the speed of locomotion, and nine changed mobility technique, when they approached the landmark. Eight pupils began to talk about the landmark before they reached it.

Taking a short-cut in the route, which reflects knowledge about the spatial relations of landmarks, was shown by seven of the participants. Twelve pupils became more attentive towards the landmarks, and seven pupils showed marked improvement in the use of mobility techniques.

For thirteen of the participants, one or more positive communicative change was recorded; a total of 75 different communicative events. The four pupils with the most severe language and communication problems, showed marked improvement in communication skills at the end of the project period. The most common forms of communicative change were: more conversation during navigation of the route, repeating instructions given by the teacher, and communication about wants by walking to the location of an object or activity.

Positive changes in activity level, initiative, mood, or sense of well-being, were recorded for 12 of the 16 participants; a total of 53 recordings. Increased activity and initiative within a trained route, was recorded for ten pupils. One example was a multiple disabled man with a severe passivity problem, who started to use a trained mobility route for new purposes. The route passed by a gas station, and the man began to walk the route to the gas station to buy icecream for himself and other people at the ward where he lived.

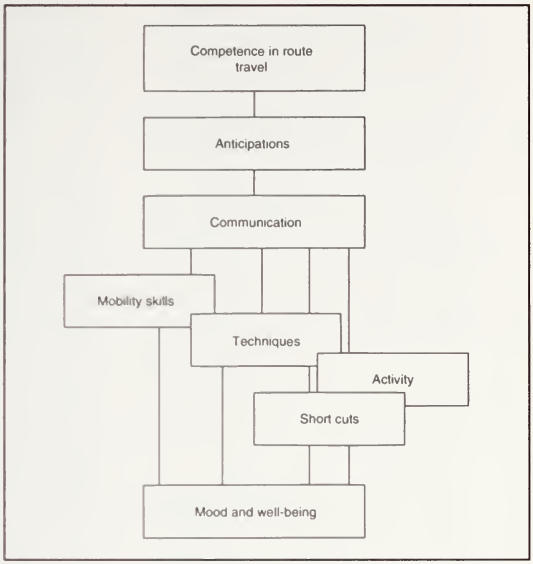
For eight pupils, increased activity and initiative was reported in other daily-life situations. The questionnaires reported increased self-sufficiency for eleven, and better ADL skills for seven of the participants. For three of the multiple disabled participants, it was emphasized that they had bettered their social interaction during the project period.

The serial rank order of the shifts

For each of the participants, the shifts was assigned a rank according to the

Figure 1.

Order of qualitative shifts in behaviour and mood.



order in which they occurred, and mean rank order computed. The differences in mean rank order, which reflect how relatively early the shifts averagely occurred, are shown in Figure 1. The relative serial order of 'independent travel', is also included in the figure.

As shown in Figure 1, the participants clearly tended to obtain 'independent travel' before any of the generalized positive changes were shown. The mean number of trials before the change occurred, was significantly lower for 'independent travel', than for any of the other shifts ($p < .01$, t-test, two-tailed). Among the qualitative shifts, anticipation of landmarks usually appeared first; mean rank order = 2.1. It occurred as the first in 20, and as the second change in 8 of the 37 routes in which rank orders could be assigned. The difference in mean rank between anticipation and the other qualitative shifts, was statistically significant ($p < .01$, two-tailed).

The differences in mean rank order between communicative shifts, changes in mobility techniques, short-cuts, and other mobility related changes, were relatively small. This reflect the fact that their appearance varied in order from one pupil to another. Only the difference in mean rank order between communicative changes and short-cuts, reached statistical significance ($p < .05$, two-tailed). Positive shifts in activity, initiative and mood, appeared significantly later than the shifts which were directly related to mobility skills and orientation ($p < .01$, two-tailed).

DISCUSSION

The wide range of shifts in mood, activities, and mobility performance shown by the participants of the Tambartun project, demonstrate that functional mobility route training may affect most areas of life in a positive manner. Such effects are probably caused by a variety of factors, and can not be attributed to the acquisition of isolated mobility skills. In order to achieve generalized learning effects, the mobility route training must be integrated as a part of a comprehensive plan for habilitation or rehabilitation of each individual. The integration of mobility route training within a more comprehensive plan, makes it difficult to single out effects that can be attributed solely to the route training. Nevertheless, mobility route training increases in significance for the life and welfare of visually impaired persons; - becoming a crucial part of a more effective comprehensive plan for habilitation or rehabilitation.

The observed serial order of qualitative shifts, seems to reflect three successive levels in the development of environmental coping:

Level I. Competence in travel

Level II. Acquisition of knowledge linked with the obtaiment of personal goals

Level III. Attainment of coping experiences, motivating new activity

Expressed in this way, the serial order seems to be a stable phenomena, to be reproduced in any successful mobility training. Independent travel, acquisition of knowledge linked with obtainment of personal goals, and coping experiences, may be linked together in a positive transactional chain. If so, it has important practical implications for how mobility training should be planned, executed, and evaluated.

That independent travel tended to be the first positive change observed, probably reflects the fact that goal-directed mobility route training has a priming effect on other kinds of learning. In the first phases of mobility route training, the teacher directs the attention of the pupil to the landmarks and the directions between them. Independent travel, however, implies choosing a plan which makes it possible to move between landmarks. Such a plan specifies goal-directed actions, and introduces a new relationship between the pupil and the environment in which the route is placed. Certain features of the physical and social context stand out as important with respect to the plan, while others are not paid attention to. Thus, the goal of the mobility route determines the features of interest, and affects what is learned.

Orientation and understanding of spatial layouts naturally develops from goal-directed activity towards the mobility goal. Since independent travel requires information about landmarks, directions, and distances, it implies acquisition of layout knowledge, which in turn associates with orientation skills. Learning orientation skills also become easier when independent travel is established, since it reduces the cognitive load of the pupil. When competence in travel is achieved, it is easier for the pupil to attend more effectively to features of the environment related to the mobility goal, as well as to social and physical events which

occur during navigation of the route. Furthermore, spatial understanding and orientation may reflect itself in communication about objects, events and places, and appear as the ability to make a short-cut in the route.

To obtain effective learning and generalized learning effects, the pupil must understand why it is important for himself to reach the goal of the route. Generally, learning to achieve functional goals, makes training meaningful and satisfactory. When a person feels responsible for obtaining a goal, he gets emotionally involved in the result of his efforts. A successful result is deeply satisfying, and leaves a vivid memory of the situation encountered. An unsuccessful result is, on the other hand, not easily forgotten. The satisfaction of mastering a route, is consequently associated with a feeling of well-being that have positive effects in terms of being happy and feeling comfortable in daily life (Dreyfus & Dreyfus, 1986). Generally, attainment of personal goals and the mastery of related skills, leads to an experience of coping. In such a way, the positive changes in mood and feeling of well-being, may be directly caused by the growth in performance. The positive changes in initiative and level of activity, may be explained in a similar manner.

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MOBILITY ROUTE LEARNING AND ENVIRONMENTAL INTERACTION

Jon Magne Tellevik, Bengt Elmerskog, Harald Martinsen and Magnar Storliløkken

Tambartun National Resource Centre for Special Education of the Visually Impaired,
N-7084 Melhus, Norway
and University of Oslo.

INTRODUCTION

Mobility route learning is often assumed to have little relevance for the development of spatial understanding and social interaction, and the life of the individual in general. A 'tunnel' or 'strip-map' metaphor is often used, to characterize the kind of knowledge assumed to develop in mobility route training. Individual competence is believed to be highly situated, or context-bound, and entirely dependent on external support. In a cognitive perspective, the knowledge acquired is believed to be situated in a specific context, and to have no general applicability across situations. According to such a view, subjects may become 'routine' experts by virtue of their efficiency in applying acquired procedures, but still lack knowledge of other important objects in the domain or field where they travel; showing a kind of robot performance applying acquired procedures about landmarks and turns in a route.

In the present paper we will argue that mobility route learning, when certain conditions are met, is an efficient means for the development of the kinds of knowledge linked with competence in travel and social interaction. We will argue that these kinds of knowledge efficiently develop through goal-directed mobility route training, and show the effects of such training for three cases, and by describing the order of qualitative shifts in behaviour observed in learning a route.

Acquisition of skills and comprehension.

In the acquisition of skills, qualitative different progress is made when conceptual knowledge is developed; i.e. knowledge about the nature of the objects of the procedures (Hatano & Inagaki, 1992; Perkins & Salomon, 1989). Forms of conceptual knowledge that change in response to mentally exerted actions, and thus can be used to run mental simulations, may be called mental models (Gentner & Stevens, 1983; Johnson-Laird, 1983). When we possess a mental model of the target object, we can understand the meaning of each step of a given procedure in terms of the change it produces in the object. By running a mental model we can also predict what will occur in new situations.

A major qualitative change seem to

occur when subjects adopt a hierarchical view of decision-making. A level of competence (Dreyfus & Dreyfus, 1986) in performance is primarily dependent on conscious assessment of elements that are salient with respect to a plan, and analytical rule-guided choice of action, followed by an emotionally involved experience of emotion of the outcome.

Mobility route training may affect comprehension activity in widely different ways. When people experience a target they value, they become more likely engage in active and enduring attempts to understand it better. Mobility routes must be constructed for some meaningful purpose, in order to afford exploration and opportunities to effectively reach a desired goal. If not, the mobility routes may suppress the motivation to comprehend. Thus two conditions must be met in order that mobility route training may affect comprehension activity. Firstly, the individual must understand why mobility skills are necessary for the attainment of a desired goal. Secondly, the expectations for immediate reward must not be too strong.

CASES

Case 1: John. Using the route to obtain environmental information.

John is mentally retarded person 45 years of age suffering from retinitis pigmentosa. He has tunnel vision. Before systematic route training was initiated, he was heavily dependent on verbal and manual support from a helper in travel. He was anxious when travelling, walked in a rigid and staccato way, and extremely dependent on information from the route.

Shortly after systematic mobility route training was started (3-4 trials), he was able to travel on verbal instruction without the need of any additional support. After 3 more trials, he walked the route with the instructor trailing 20-30 m. behind him. However, he was still very anxious and dependent on the landmarks and guide lines in the route.

A few days later his performance changed significantly. He started to anticipate and to communicate about the landmarks in the route. He became more relaxed, and increase his speed of travel. He also attended to new features of the route, and started to use the cane to obtain echoes from object. This pattern of exploration was then extended to other more distant objects, which led to communication about, for instance, a field with flowers, and the sound of a river. His use of the cane and mobility techniques also improved.

Generally, the case of John demonstrates that the effects of mobility route training is not restricted to the acquisition of procedural route knowledge, but demonstrate a coping experience, how a feeling of success in travelling reduced anxiousness, and contributed to general knowledge of the environment.

Case 2: Peter. Using route learning to obtain social contact.

The effect of mobility route training on exploratory and social initiatives may be illustrated through describing Peter's mobility performance. Peter is a blind, mentally retarded man, 47 years of age. He felt anxious about travelling, and did not dare to travel on his own. Usually he sat in his bed rocking back and forth. He used his body and legs for tracing, but was very reluctant to use his hands.

Apparently, he only attended to tactual information from the route.

The first mobility route in which Peter trained, was a short route from his own room to the kitchen table, and he needed about 140 trials before he mastered it. However, after achieving competence in the route, his interaction with the environment markedly improved. He began to explore his home, independently defining new landmarks, among which many were auditive. For instance, when he heard someone talking, he went to the staff room, which led to him being offered a cup of coffee. He thus obtained new knowledge about the environment and increased social contact.

Case 3: Arthur. Using route learning for environmental, communicative, and social interaction.

Arthur 42 years of age, blind and mentally retarded, was able to move at will around the house in which he lived, and its surroundings. When he travelled outdoors and used a cane, he was very dependent on support and prompts from a helper. He was easily frustrated, when met with demands, and seemed to have no sense of directions.

The first route Arthur learned, went from his own house to the local gas station were he used to buy himself sweets. After 16 trials, he could walk this route independently. He then began to walk to the gas station to buy cookies, ice cream and chocolate, which he served to his co-habitants at the afternoon coffee break. Generally, his frustrations lessened, and his social activities increased.

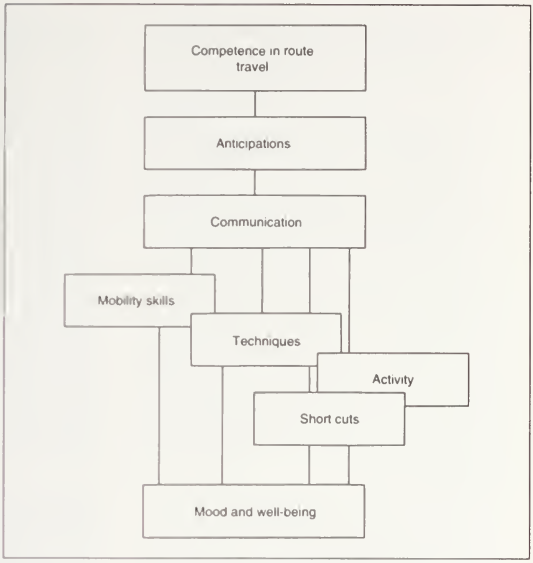
Shortly afterwards, the first route was extended to a nearby small restaurant, the shopping center, the bank and post office. He mastered this extension of the route in 10 trials, and used it, on his own initiative, to mail sound cassettes to the Association for the Blind, cash money in the bank, and buy coffee and cakes at the restaurant. At home he started to make dinner and set the table. When visiting these places, he also frequently talked with people. After a while a significant positive change in mood and well-being was observed. The mobility route training thus started a chain reaction which significantly changed his social life space. Presently, he manages daily living activities on his own. He is constantly exploring and extending his activity space, and is more attentive towards auditory information from the environment. His sense of directions has apparently improved, and his language and communication skills, have improved significantly.

LEARNING IN ROUTES

In the 1989-91 Tambartun study the development of mobility and orientation skills in mobility routes was systematically studied for blind children and adults at different cognitive levels (Storliløkken, Martinsen, & Landrø, 1991). The findings suggest that major qualitative shifts in behaviour occur when blind subjects learn mobility routes leading to desired goals. The shifts observed, seem to be in accordance with findings from studies of skill development, in which descriptions of factual and strategic knowledge in novice and expert performance is given (Brown,

Figure 1.

Order of qualitative shifts in behaviour and mood.



Bransford, Ferrara, & Campione, 1983; Chi & Ceci, 1987; Hatano & Inagaki, 1992)

A mobility route can be considered meaningful, when it contains a desired goal which naturally defines a context for learning for both trainer and trainee. In the Tambartun project, the targets were always objects or events which were of value for the subjects in their daily life. Thus, the targets created necessary motivation to engage in decision-making and comprehension activity. The routes were learned for some particular purpose, which were intrinsically motivating for the subject.

Further, in order to induce decision-making and comprehension activity, routes must afford exploration and opportunities for modification of travel.

A route which is highly standardized in relation to correct answers and for immediate reward, very rarely encounter comprehension activity. We shall illustrate the interaction between exploration, attention, uncertainty and success in mobility route learning, by describing some of the results from the Tambartun project.

Qualitative shifts in behavior in learning mobility routes.

In the Tambartun project, a relation was found between increased competence in travel and several kinds of positive changes in behavioral patterns and mood. The order of the qualitative shifts in competence in travel, behavioral patterns and mood, is shown in Figure 1.

When subjects established competence

in travelling a route, i.e. were able to travel the route on instruction related only to the first landmark, significant qualitative shifts in behaviour were observed. The first significant shift observed was anticipations of landmarks. Anticipations, or preview, may take many forms. Most frequently, the subjects slow down, speed up, or stop before the landmarks of a route. Anticipations may also appear as changes in directions, changed use of the cane, or protective actions as, for example, lifting, or lowering the arms. Frequently, subjects show joy and excitement immediately before reaching the landmarks, and often start talking about the landmarks. Such anticipations indicate discovery of new relations or qualities, associated with the landmarks.

The next shift in behaviour were associated with communication and language use. Attention to landmarks positively affected communication and language use. Such events occurred significantly later than anticipations to the landmarks, measured as the number of days and number of trials before the change in behavior occurred. The relative order of these changes may be caused by the fact that travelling a route, with or without help from the trainer, results in environmental and social feedback for success or failure in the route. The route may thus function as a frame for the development of language and communication abilities.

Next in order, several changes in behaviour appeared more or less simultaneously, including increase in general activity, improvement of mobility skills and techniques, and initiatives to modify travel plans. Typically, the subjects became more attentive towards appropriate cues. They chose new landmarks, or excluded landmarks by taking short cuts in the route. Both tactual and auditive landmarks were chosen. The subjects who attended to auditory cues, seemed to be more able to traverse unknown segments of the field by taking short cuts when doing so was appropriate. The subjects who were proficient in using auditory cues, also seemed to obtain a better understanding of the spatial layout than those who were more dependent on tactual cues. The positive changes in travel competence and behavior, obviously created a positive shift in mood – a feeling of well-being – which appeared significantly later, than the other changes observed.

DISCUSSION

Procedural knowledge is often quite sufficient to deal with problems that are frequently encountered. In this respect, the 'strip-map' or 'tunnel' metaphors may be suitable. Although performance has become dependent on acquired route knowledge and mental representations, the domain incorporating the route primarily consists of rigid procedures. The order of actions or steps within a procedure is fixed, and none of them can be replaced by comparable ones. Thus knowledge is still situated, in the sense that it does not have general applicability across situations. Such knowledge often fails to transfer. Even minor situational changes often makes problem solving unsuccessful. Knowing a route standardized for no other purpose than the training of basic mobility skills, very rarely encounter comprehension activity. To make mobility route

learning effective for spatial learning and understanding, subjects must be motivated to pursue adequate comprehension or satisfactory explanations.

However, the cases and the results from the Tambartun study, demonstrate that mobility route training may be an effective means for the development of independent travel, communication, and social interaction. When the two conditions meaningful goal-directed activity and opportunity to engage in exploration activity are met, blind and visually impaired people are likely to encounter comprehension activity. As an effect of functional mobility route training, several events seem to occur in a relatively fixed order. Thus, mobility routes may be a convenient means for creating positive changes in skills, abilities and mood.

The qualitative shifts in behavior patterns and mood observed in the Tambartun project, may be explained by the mastery of personally relevant procedural skills. Competence in travel in a route makes it possible to allocate attention to other aspects in a spatial layout. The route may function as a reference point for exploratory activity. Exploring a spatial layout, requires a feeling of certainty and self-confidence, which may be acquired through learning a route. Exploratory activity is also associated with risks, threats as well as opportunities, and requires reasonable costs and benefits for the subjects. Success in routes gives a necessary confidence in venturing into unknown places, and to adjust travel according to information that seems salient for obtaining a goal. Exposing oneself to such challenges, being reasonably sure of success, induces joy and excitement, and an urge to communicate about your experiences with others (Dreyfus & Dreyfus, 1986). Such activity frequently leads to communicative and social interaction important for learning, such as discussion, controversy and reciprocal teaching in the domain (Palincsar & Brown, 1984).

We like to stress that to obtain such effects, it is important that subjects are free from urgent needs, i.e. material rewards or correct answers. People can pursue comprehension only when the pressure to perform correctly is not so strong. Engaging in comprehension activity is seldom the safest or shortest way to success. If people perform a procedure only to obtain rewards, they will often refrain from being involved in comprehension activity even when cognitive incongruity is induced. They will certainly be reluctant to risk varying the procedures, because they usually believe that safety lies in relying on the conventional version.

The kind of reward important for the subjects learning mobility routes, is that understanding is valued by the reference group members. The encouragement of comprehension by reference group members will lead an individual to form metacognitive beliefs which emphasize the significance and capability of comprehension, especially in the domain in which expertise is acquired. This will make comprehension activity more likely to occur. When comprehension is valued by others, people are often required to explain the appropriateness of a procedure, both to themselves and others. They may then try to construct mental models of the objects in the route and the target as a basis for explanation.

Ability to travel in a route, thus creates opportunities for activity related to other goals or purposes than the ones initially established. Routes may be considered as prerequisites for initiating and attaining

environmental and social interaction. It must to a large extent be considered as a means for interactive ability, not only restricted to the development of spatial knowledge.

Using a route for such new purposes makes mobility route training significant for many skills and abilities important in daily life. The knowledge that is established through route training is not only procedural, but also declarative in a very broad sense. Along with procedural knowledge, emotions, language, and communication become part of spatial declarative knowledge.

Subjects that acquire conceptual knowledge of the major objects of a domain, in addition to procedures for solving problems, may solve various novel problems of the domain. In contrast to novices and 'routine' experts, they are able to achieve a goal in spite of eventual lack of external support. Their knowledge of the route is still situated in the sense that it reflects the history of acquisition and its use, but is desituated in the sense that it is no longer associated tightly with the situation in which it was originally acquired. In mobility learning subjects may invent new routes by mentally combining other landmarks and turns and ways to attend to them. This comprehension activity is not only restricted to environmental knowledge, but also incorporates persons and social objects associated with it.

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Wayfinding and learning of spatial relations. The effects of different orientations and mobility strategies.

J. M. Tellevik and H. Martinsen
University of Oslo, Norway

Orientation and mobility teaching methods have been influenced by an Euclidean conception of space. Spatial orientation and wayfinding have generally been discussed in terms of cognitive mapping, and believe to involve spatial knowledge of objects and salient landmarks in relation to one's position in the spatial layout. Mapping strategies have been used to highlight the defining characteristics of the Euclidean space. In order to be able to represent cognitively the interrelated distances and directions of a given space, blind pupils have been told to expolre its perimeter, and to cross it sideways and lengthwise.

The traditional emphasis on teaching layout knowledge may be contrasted with teaching blind pupils to find a specific target, a place in space, or an object. This might be regarded as teaching mobility as a wayfinding skill, – teaching «how to do it». A blind person may find an object or a place in space, without referring to an Euclidean representation. The role of wayfinding experience in developing spatial knowledge, is discussed by, among other, Gibson (1979) and Siegel and White (1975).

In the field fo orientation and mobility, wayfinding skills have mainly been taught in mobility routes. In such routes, naturally occuring landmarks and other objects are systematically used as stations along the route. The primary task of the pupil is to find his way from one station to the next until the goal is reached. Attention is focused primarily on directions and turns along the route, and less on distances between the landmarks and relative locations.

The two different mobility teaching strategies – mapping and route strategies –, direct attention to diferent aspects or features of the orientation task. This difference might be discussed in relation to explicit and implicit, or S-mode and U-mode, learning (Reber, 1967; Hayes and Broadbent, 1988).

The implicit mode of learning, U-mode, involves non-selective and passive aggregation of information about events and environmental features. It corresponds in some respects to typical skill learning. The person who has learned something in the U-mode, is typically unable to describe what he has learned; i.e. how the skill is performed. The explicit learning mode, S-mode, is in contrast selective. It is typically associated with problem solving tasks, requiring effort, and the person is able to describe the solution.

In a route strategy, where the attention is focused on how to find the way form one station to another, wayfinding skills rather than layout knowledge are more likely to be linked with S-mode learning. The spatial relationships, including distances and the shape and size of the room, are more likely to be learned implicitly. In a mapping strategy, the learner more readily attends to the shape and size of the room, and spatial relations between objects. These aspects of the orientation task are more likely to be learned in a S-mode.

It is difficult to assess the relativ use of implicit and explicit learning in a specific orientation and mobility task. It seems, however, unlikely that a person functions in an U-mode with regard to the shape, size and key features of the room if he is instucted to follow a mapping stategy.

However, if instucted to follow a route stategy, it is feasible that the person succeeds in finding his way without being aware of the cues employed, i.e. without functioning in an S-mode with regard to them.

In the present study, subjects were given the task of finding four target objects placed in an unfamiliar room, and instructed to follow either a mapping, or a route strategy.

After finding the objects, they were asked to relocate the objects and estimate the relative distances between them. It was hypothesized that the different strategies should facilitate different kinds of learning. A mapping strategy should favour layout knowledge, a route strategy more readily directional knowledge.

Method

Subjects and procedure

Twenty adults, 10 females and 10 males participated in the study. Their age varied from 19-52 years of age. The subjects were blindfolded, videotaped, and tested on 2 subsequent days in an unfamiliar room. On both days, they were led to a starting point, the door of the room, and told to find 4 different objects (a chair, a table, a waistbasket, a lamp) placed at different locations in the middle of the room. On the 2 observations, they were given different instructions about how to move around in the room. One of the instructions aimed at imposing a mapping, the other a route strategy. When the subjects had found the four objects, they were given two relocation tasks and a relative distance judgement task.

The instructions

In one instruction subjects were asked to explore the boundaries of the room, and to cross it lengthwise and sidewise when departing form the walls. The other instruction encouraged the subjects to use found objects for finding others, and to enter the middle of the room with various angular directions. Subjects were not allowed to follow the wall using more than three successive steps, and instructed to depart from the wall whenever hitting a door, a window, a piece of furniture, etc.

The tasks

Relocation I – drawing. The subjects were asked to indicate the starting point and place the target objects on a raiseline paper.

Relocation II – walking to the location of the objects. After the subjects had found the target objects, the objects were removed from the room. For each of the four objects, the subjects were led to a different corner, and asked to walk to the place where the object had been located.

Relative distance judgements. The subjects were asked to make triadic comparisons of the distances between all 15 object pairs: e.g. «Which distance is the longest, between the chair and the lamp, or between the chair and the table».

Measures On all three tasks, «hits» were defined On the relative distance judgement task, correct answers were scored as hits On the relocation tasks, hits were recorded when a target object was placed within an area relative to a deviation of 60 cm. in either direction form the correct location.

Results

Differential effects on the two instructions

Contacts with the objects in the room.

The route strategy, induced by teling the subjects to find their way from one object to another, was meant to focus attantion on the directions between the objects. Since the task was to find the objects placed in the room, it might also be regarded as more Goal-directed than the mapping strategy In accordance with such a view, the route strategy leads to a higher number of contacts with the objects than the mapping strategy did. This is shown in Table 1

The differences in the frequencies of contacts with the target objects, suggested that the subjects have more opportunities to aquire objects information when they follow a route strategy, than in the mapping stratgy condition. This adds to the inherent differences between th two strategies. The route strategy both focuses the attention on the directions between the objects, and increases the opportunity to learn about the objects and the relations between them.

Table 1. Number of target object contacts.

Strategy	Mean number of contacts	s. d.	t-test
Route	9.9	6.44	t = 2.43 p < 0.2,
Mapping	5.9	2.21	one-tailed N = 20

The relative distance judgement task.

The relative distance judgement task – the triadic comparisions – involves knowledge about how the objects are placed in relation to eachother. It is not sufficient to know in what direction an object is placed in relation to each of the others. The subject must either, in addition, form some representation of the spatial relationships, probably including the extent and shape of the room, or master the problem by some time/speed computation. As expected, the mapping strategy was linked with good, and the route strategy with poor relative distance judgements.

The number of correct scores on the relative distance judgement task – the number of «hits» – were compared between the two instructional conditions (t-test). The two means and the result of the analysis is shown in Table 2.

Since number of object contacts was regarded as a measure of learning opportunity, the relations between object

Table 2. Mean no. hits relative distance judgement task.

Strategy	Mean number of contacts	s. d.	t-test
Route	7.3	3.16	t = 2.13 p < 0.3,
Mapping	9.6	2.69	one-tailed N = 20

Table 3. Number of contacts with the target objects for «good» and «poor» solvers on distance judgements

Strategy	«good» solvers	«poor» solvers	
Route	62	136	198
Mapping	73	45	118 N=316

Table 4. Mean no. hits relocation tasks

Strategy	Mean number of hits	s.d.	t- test
Drawing			
Route	1.1	.85	t = .18 n.s.
Mapping	1.2	1.07	N = 20
Walking			
Route	1.7	.90	t = 1.45 n.s.
Mapping	2.1	1.09	N = 20

contacts, strategy employed, and successful relative distance judgements, were assessed. The subjects were divided into «good» or «poor» solvers according to wether they had more or less than 10 hits. The difference between the number of object contacts is shown in Table 3.

A significant difference (Chi=28.2, p<.0001) was found. As clearly shown in a Table 3, this is due to the fact that those who became poor solvers, had a very high number of object contacts when following a route strategy.

The finding supports the presupposition that directions, not distances, are learned in a route strategy. It further suggests that learning about directions diminishes learning about distances. It seems that the better the learning opportunities are, while a person is focused on how to find the objects, the worse he succeds with relative distance judgements, – a layout knowledge measure. Under the route strategy condition, the subject do not fully integrate the Euclidean characteristics of the space.

The relocation tasks

Comparisons showed no strategy effects on the performance on the two relocation tasks (see Table 4).

Thus, neither finding back to the place where an object was after it had been removed, nor placing the objects correctly on a drawing were linked with the kind of search strategy the subjects had been instructed to follow

Table 5. Number of contacts with target objects for «good» and «poor» solvers

Strategy	«Good solvers»	«Bad solvers»	
Drawing			
Route	155	43	198
Mapping	79	39	118
		N=316	
Walking			
Route	129	69	198
Mapping	91	27	118
			N=316

The relocation tasks involve both knowledge about distances and directions As expected and shown above, distance knowledge was primarily linked with a mapping, not a route strategy (cf Table 2) Directional knowledge may be aquired by both strategies, but a mapping strategy should favor relocations more than a route strategy does On the other hand, a route strategy involves more object contacts, and thereby better learning opportunities than the mapping strategy does The above lack of a strategy effect, may result from these conflicting influences

The effect of contacts with the objects

To check whether the strategy effects were masked by differences in learning opportunity, the number of contacts were compared between «good» and «poor» solvers following a mapping and route strategy, cf Table 5

The subjects were assigned to two groups according to task performance on the relocation tasks A «good» solver was defined relative to the means for the tasks, i.e 1or more hits for draw-ing, and 2 or more hits for walking performance. Subjects who scored below these criteria, were defined as «poor» solvers.

When relocation performance for good and poor solvers across strategies were considered, significant differences were found both for drawing performance ($Chi = 9.94$, $p < .03$), and walking performance ($Chi = 5.01$, $p < .03$). The tables show that successful relocation is linked with a high frequency of object contacts regardless of the strategy followed. In addition, the number of object contacts was higher among the good solvers following a route strategy, than among the good solvers following a mapping strategy.

The findings are in line with the assumtion that the lack of strategy effect was caused by conflicting effects. Success on the relocation tasks is clearly related to learning opportunity. The higher amount of object contacts among the good solvers who followed a route strategy is, however, harder to interpret. There was no difference between the number of good solvers in the two instructional conditions, which makes it unlikely that a route strategy favor relocation performance more than a mapping strategy. A better explanation may be that the relocation tasks are favored by a mapping strategy, and that more learning opportunities are needed if a route strategy is emplyed.

DISCUSSION

In any teaching context, the learning objective is singled out and consequently learned explicitly – in an S-mode. It follows that the mobility teacher must make a clear choice between teaching wayfinding skills or spatial interrelationships. In a mapping strategy, Euclidean characteristics of the space is selected for S-mode learning, and the spatial interrelationships learned in an U-mode.

Focus on layuot knowledge or on how to find one´s way through a route, direct attention differently and have different learning effects. A route strategy is more clearly goal-directed, and enhances «how-to-do-it» learning. Such selective attention on the location of landmarks, restricts acquisition of layout knowledge. In comparison, a mapping strategy favor knowledge about spatial interrelationships, reflected in better relative distance judgements. The choice of strategy should be made according to the pupils´ educational needs.

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Notes

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